

Tech Trek

Powers of Observation

Throughout your visit on the Tech Trek Mobile Research Laboratory, tune in your powers of observation and use your senses to **fill- in the information below**. Information may come from **various sources**. The preparatory CD may also be helpful. It is your responsibility to glean the answers to the questions below.

Catch as many answers as you can with the time you have on board!

Good Luck!

SEM

1. The abbreviation, SEM stands for: _____
_____.
2. There are various uses for the SEM, including:
 - a) _____
 - b) _____
 - c) _____
 - d) _____
 - e) _____.
3. Specimens must be prepared prior to being loaded into the SEM. Each object is required to be _____ and _____, and then they are coated with _____.
(or sometimes other metals)
4. Objects in the SEM, are displayed in _____ and _____, while objects under the light microscopes are observed in color.
5. The reason that SEM objects appear as they do depends on the environment that the specimens are in, when you visualize them. They are locked inside of a _____, which is devoid of air. Therefore, they do not transmit color waveforms.
6. As the Sputter Coater machine coats the specimens, the metallic substance moves through the full range of phase changes. These phase changes are: (in order) solid, _____, _____, liquid again and back to the original _____ state of matter. (No plasma phase, right?)
7. During sputter coating, the metallic substance mixes with _____ gas, which is purple neon- like gas that you can visualize. (It is in the chemical family of gases used for sign making).
8. When using a microscope of **any** kind, we always begin by (1) centering the object, (2) starting at the lowest _____. (3) Then we focus. These are three basic steps to begin with, no matter which microscope you are using.
9. Objects on the SEM are measured on a scale in μm (which is micrometers). There are $1000\mu\text{m}$ per _____ millimeter (mm). Therefore, there are one _____ micrometers (μm) per meter. μ is the Greek letter pronounced, "Mew".

10. ** Measure an object in micrometers on the SEM. Name the object:

_____.

Name the function or specific reference point on the object.

_____.

Convert the measurement from μm into mm.

_____ μm which is equal to _____ mm.

11. The cost of a SEM can be as little as one hundred thousand dollars. The typical ESEM (Environmental type) used in research, such as those at WPAFB, can be upwards of _____ dollars. (Lots of zeros!)

LIGHT MICROSCOPE / GENERAL PRINCIPLES

12. The “focus” knob(s) on a light microscope is generally located on the side of the microscope. The large outer knob is the _____ and the inside smaller knob is called the “fine” focus. Use the _____ knob, first.

13. Name a “type” of pollen and one other object featured in the artwork hanging on the walls _____ pollen (?) _____.

14. Name at least three associated careers or professions that would routinely use a microscope as a scientific tool. (1) _____ (2) _____ (3) _____.

15. Recall one of the many inventions, commercial products or technologies developed by utilizing microscope technology. (1) _____

16. The term used to describe the science which helps determine the best substance to construct a desired product from, for a specific purpose, is called _____ Science.

17. CSI is an acronym for _____ Investigations, which is actually using the science of _____.

18. Research in process now, or “in the pipeline” for various things can take anywhere from five to _____ years to develop, perfect, produce and market. Many inventions are not released to the public sector for even longer timeframes and are proprietary. (for military, private use)

19. The study of _____ focuses on insects and other animals to better understand a species. We can also cultivate ideas and convert them into useable inventions for mankind, by observing their capabilities and adaptations. Examples include: Antennae for car antennas, insect-like robotic arms, camouflage, wing structures for aerodynamics, insulation, waterproofing techniques, directional camera lenses, etc. Can you think of another naturally inspired invention? _____

20. Light microscopes come in various forms. But the terms for the identifying structures are fairly universal. So, we say that we place a specimen on the _____ of the microscope.
21. Specimens under a light microscope are exposed to the environment surrounding them, where _____ is present and light waves can travel through this fluid. (Yes, it is considered a “fluid” although it is not wet.)
22. Specimens on glass slides are prepared using special dyes called _____. They allow us to visualize structures in various colors such as purple, pink, blue, green or brown.
23. When objects are visualized under any microscope, the magnification is represented by a number followed by a “_____”. This means the number of times the object has been magnified when compared to the unaided or naked eye. (hint: “___” marks the spot.)
24. A dissection or botany microscope will allow us to place large objects on the stage that can also be visualized fairly well without a microscope or _____. (Think big)
25. Educational Outreach at WPAFB is on a mission to help students learn and to encourage enthusiasm for science, technology, math, _____ and engineering.